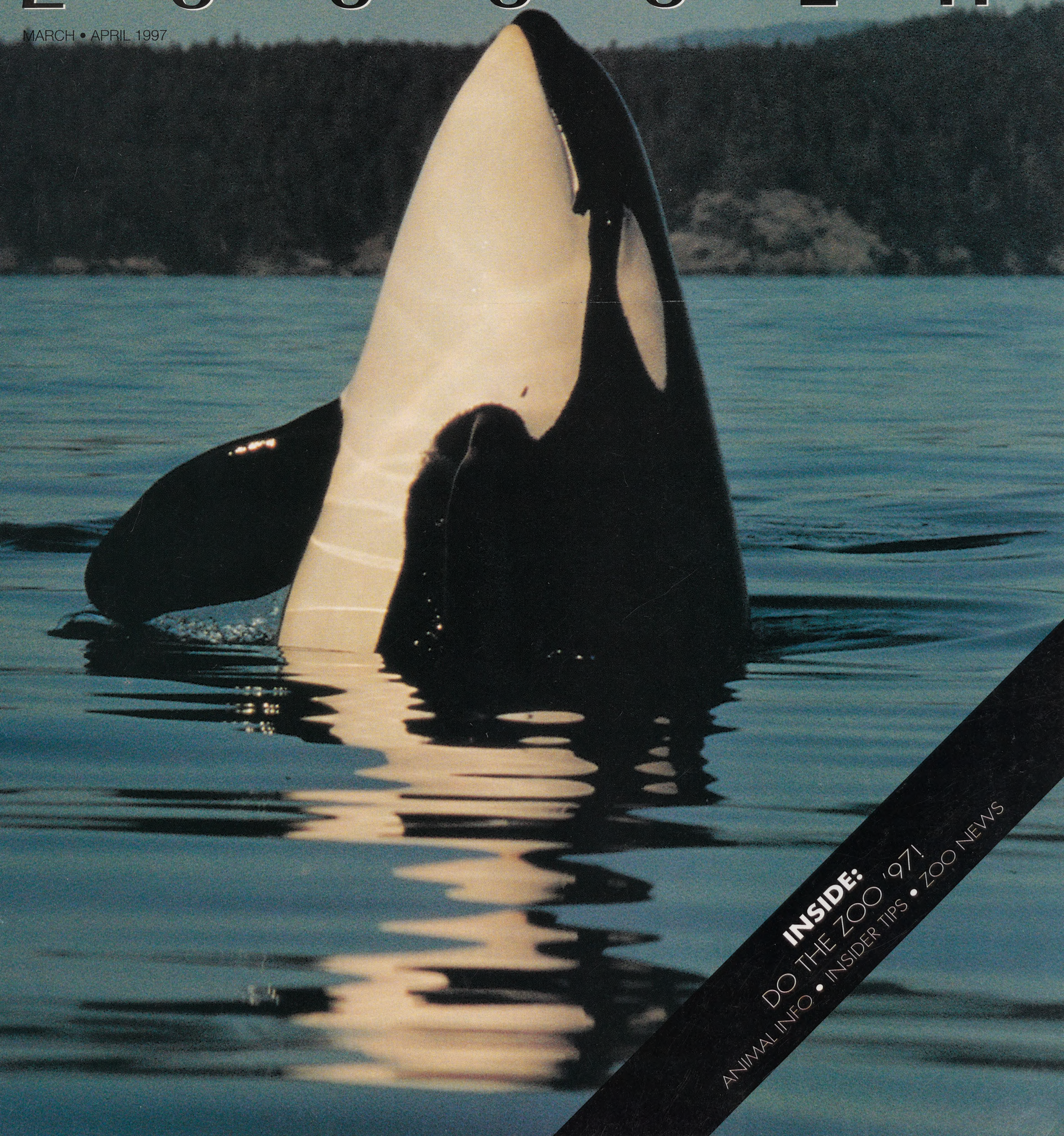


ZOOGER

MARCH • APRIL 1997



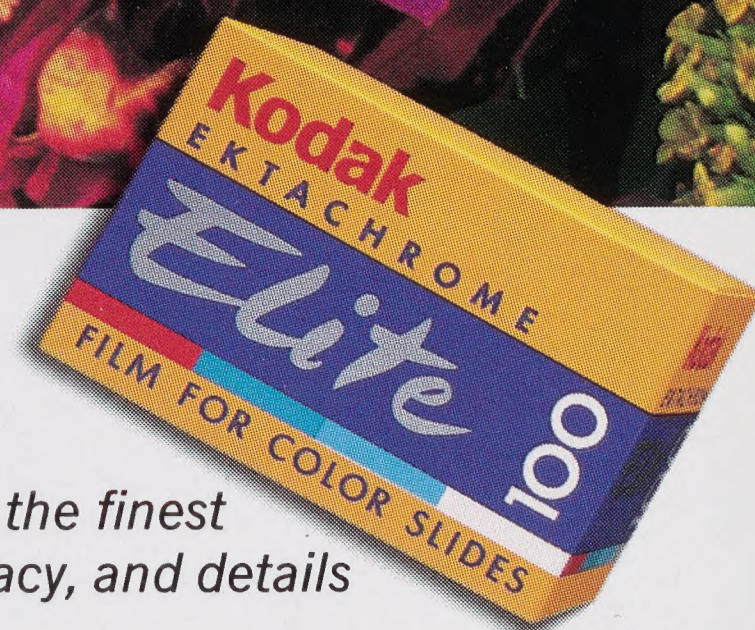
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Killer Whale, by Marvin Oliver. Courtesy of the Thomas Burke Memorial Washington State Museum (1996-99/21).

DEPARTMENTS

28

NOTES & NEWS

Spring events, including a panda anniversary and two ZooFari celebrations, plus two exciting new programs.

29

BOOKS, NATURALLY

Lake Victoria's dazzling variety of cichlids, an introduced killer called the Nile perch, and a scientist's African adventure in *Darwin's Dreampond*.

30

THE BIOALMANAC

Ospreys over the Bay, tiniest frog discovered, caimans in Brazil, and naming zebras and other striped creatures.

6 WATERWORLD: THE AQUATICS TRAIL

Michael H. Robinson

Whether in the form of ice, steam, or liquid, water is vital to life on earth. The Zoo's Director introduces you to a planned exhibit that explores this precious compound and the life it supports.

9 KILLER CULTURES

Robin Meadows

The complex social lives of killer whales defy easy explanation. Many mysteries are just now coming to light. For instance, Pacific Northwest populations of these predatory whales may be on the way to becoming different species.

18 A STORM IS BREWING OVER OUR OCEANS

Carl Safina and Mercédès Lee

Once considered sources of endless bounty, oceanic wildlife and ecosystems are under siege. Beware: This eye-opening account may bring a sea change in your outlook on oceans.

23 THE AMAZONIA SCIENCE GALLERY, FOR SCIENCE'S SAKE

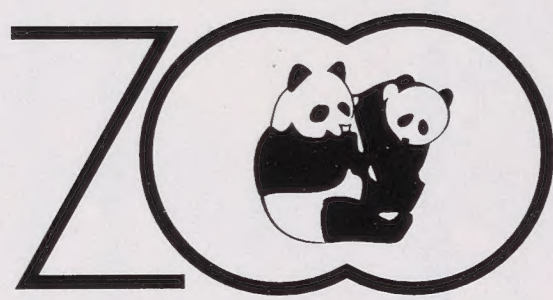
Lily Whiteman

The Zoo's newest exhibit is designed to open the world of science to visitors. Here you will meet scientists in their laboratories and explore how science is changing the way we look at the world.

SPECIAL PULL-OUT SECTION DO THE ZOO '97!

The first annual warm-weather guide to what's new at the Zoo in 1997, where you'll find insider information on how to find the Zoo's hidden treasures, animal facts, and more.

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is a nonprofit organization of individuals, families, and organizations who are interested in helping to maintain the status of the National Zoological Park as one of the world's great zoos, to foster its use for education, research, and recreation, to increase and improve its facilities and collections, and to advance the welfare of its animals.

ZooGoer [ISSN 0163-416X] is published bimonthly by Friends of the National Zoo to promote its aims and programs, and to provide information about FONZ activities to its members, volunteers, and others interested in the purposes of FONZ. Third class mailing permit no. 6282. Copyright 1997, Friends of the National Zoo. All rights reserved.

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ZOO FARI: WET, WILD, AND WORTH IT!

Each year we choose a new theme for ZooFari, FONZ's huge annual fundraiser for the National Zoo. Sometimes we highlight a group of animals, such as invertebrates; other times, an ecosystem, such as the rainforest, is highlighted. This year our focus is water: ZooFari 1997 will be "Wet and Wild"! And ZooFari for kids, now in its second year, is a "Guppy Gala."

From creeks to coral reefs and oceans, water quality and water-based ecosystems are matters of intense concern. This should come as no surprise to Washington-area residents, who no longer eat oysters from the Chesapeake Bay, who are struggling to clean up the Anacostia River, and who from time to time deal with unsafe drinking water. But problems related to water are ubiquitous.

Canada's Grand Banks, once the richest fishery in the world, is fished out. Salmon in the Pacific Northwest are nearly extinct. Coral reefs are degraded. Oil spills foul coastal waters. And the list goes on. To raise awareness about the conservation of coral reefs, the American Zoo Association (AZA), along with many other conservation organizations, has declared 1997 "The Year of the Reef." What's more, other groups have banded together to make 1998 the year of the oceans. One reason we chose water as our ZooFari theme was to support these initiatives.

Another reason for ZooFari's "Wet and Wild" theme is that the National Zoo is planning an exciting new exhibit that will "explore the centrality and uniqueness of water to life on this planet and its impact on humans and the environment." The brainchild of Zoo Director Mike Robinson, who offers his vision for the exhibit in this issue of *ZooGoer*, this exhibit will embody the BioPark theme to the fullest extent. ZooFari funds will help to achieve this vision in the years ahead.

As many FONZ members know, for all its serious and important purpose, ZooFari is a spectacular evening of fun, food, and entertainment. One hundred of Washington's finest restaurants will serve gourmet fare. Dozens of entertainers, featuring The Fabulous Hubcaps, will bring the park alive. A silent auction, sweepstakes, fish ponds, and a new arcade of games of chance will give everyone an opportunity to go home a winner. And in keeping with ZooFari's theme, beach attire is definitely appropriate.

Just as ZooFari is a fantasy evening for adults, ZooFari for Kids is every kid's dream come true. The Zoo will be full of jugglers and acrobats, singers and dancers, clowns and characters. There will be ambulances and fire engines to explore and moon bounces and games galore. And the food will include all the favorites: hot dogs, burgers, popcorn, cotton candy, ice cream, and more.

I hope you and your family will support the National Zoo and give yourselves a great time by coming to ZooFari on May 15, and ZooFari for Kids on May 9. Just call 202.673.4613 to reserve your tickets before they're sold out. You'll enjoy the wildest evenings of the year, and be helping to save the wild at the same time.

Sincerely,

Clinton A. Fields
Executive Director

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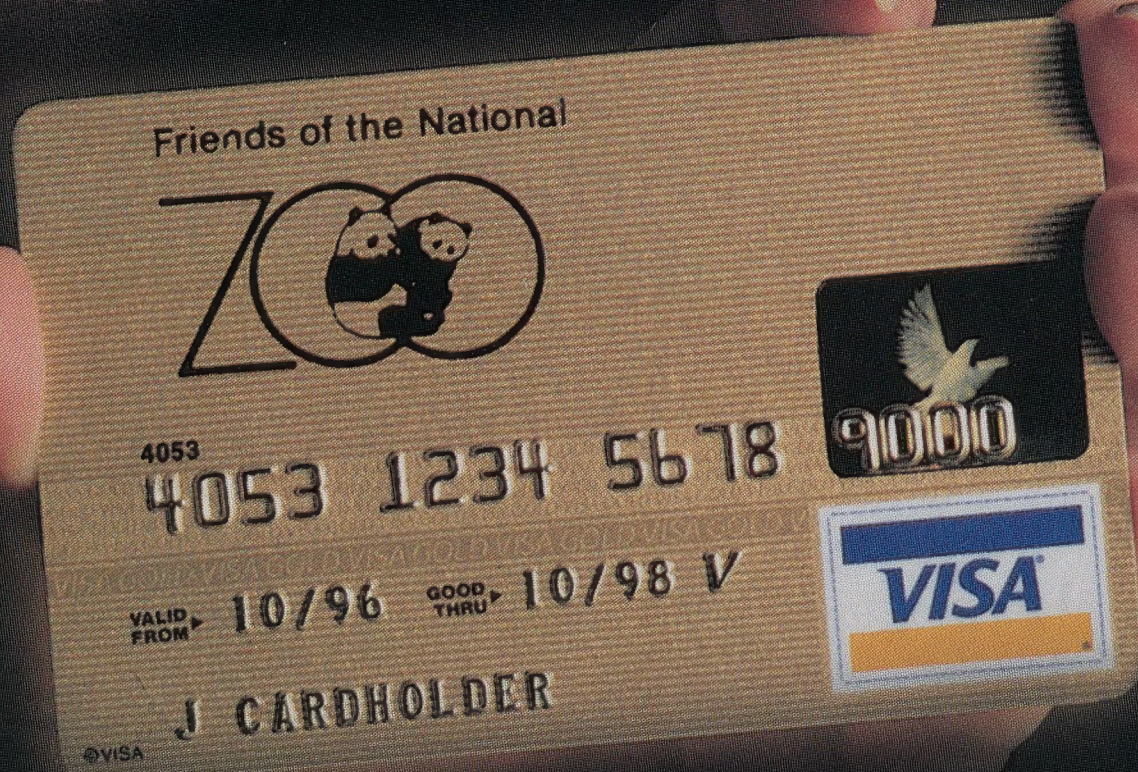
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Waterworld

THE AQUATICS TRAIL

MICHAEL H. ROBINSON

ILLUSTRATION: WILLIAM BURROWS

In 1986 when the National Zoo's Master Plan was last revised, what we all call Beaver Valley was scheduled to be developed as an aquatic trail. This trail leads past the closed swan pool and continues down to the spectacled bear exhibit. The plan, which now seems prescient, recognized that many facets of a water exhibit were already in place along the valley, but that they needed expansion and enhancement. The emphasis on water is seen in the seal and sea lion pools, the otter and beaver exhibits, and the waterfalls and the small artificial stream that runs beneath the trail and ends just above the otter exhibit. The only non-aquatic animals on this trail are the white-tailed deer, wolves, and bears. Since the Master Plan was prepared we have built the Amazonia exhibit on the lower loop of the trail, which connects to Olmsted Walk past the beautiful old waterfowl ponds. Amazonia itself is a splendid water exhibit, with its superb aquarium, and its dripping wet world of lush rainforest.

In the 11 years that have passed since our last master plan, there has been an increasing interest in, and extensive discussion about, the role of zoos. Education has been recognized by the World Zoo Association as a primary function of zoos. If the world of the next millennium is to be hospitable to the present diversity of life on earth, the human population must be bioliterate and scientifically enlightened. Zoos can no longer be just collections of large and charismatic animals or their existence will be increasingly challenged by critics. They have to become a significant part of the culture of conservation. This means continued emphasis on research and breeding endangered species, and an increased concentration on promoting concern for the natural world. But breeding endangered species is not enough. It is quite clear that we cannot be a 21st-century Noah's Ark—there are far

too many species at risk. Even if all the world's zoos pooled their resources we could save only a fraction of these species. And the ark is already overloaded. So we must become the source and inspiration of a new enlightenment, a promoter of concern, and a stimulus to action. To do this we need to highlight organic beauty and focus on areas of crisis. Water is an ideal core subject around which we can integrate so many important environmental issues, and from which we can explore biology.

Water is vital to the future of life on earth and to the survival of humankind. We live on a waterworld. More than 70 percent of the earth's surface is covered with water. Water is the cradle of life, it is where everything started. It is also the last place on earth where humans still practice hunting and gathering on a vast scale. It is the only remaining area where we have not *grown* food in significant quantities; the parallel to agriculture would be mariculture. We are inextricably dependent on water, if we are ever to colonize other planets water will either have to be there, or be provided by our future technologies. Terraforming—making other planets earthlike—is science fiction now but it may be fact in the 2000s.

The oceans have been the scenes of major changes in the world's geography. The present continents have drifted from land masses totally unlike their present forms. These existed long before the southern tips of Africa and South America separated. Rain, rivers, and glaciers have sculpted the landscapes that are the backdrops of our lives. Life, water born, was spent entirely in water for the early, immense periods of global history, compared to which human existence is a mere blink in the eye of time. The testament of fossils shows how bizarre many of the long-extinct water creatures were. When the first land animals and plants

emerged from the oceans they carried their watery heritage with them. Even now our bodies are preponderantly water: water in our blood, cushioning our brains, rounding out our eyes, and essential for digestion, excretion, and reproduction. Water is both a starting point and a central subject for educating our visitors about earth history, biology, and the complex web of life on earth.

On the eve of a new century and millennium, water has become an even more significant environmental issue. The pollution of lakes, rivers, and oceans is a major problem in many parts of the world. Waterborne diseases ravage areas where sanitation is primitive, and even afflict industrial nations. Children die from dysentery and dehydration. Erosion due to bad water management is depleting topsoils that are essential for food production, and water losses through vegetation changes are accelerating the advance of deserts at a rate unprecedented in all our history. Beyond the estuaries of the world's great rivers, huge tongues of eroded soil extend into the sea and are visible from satellites. This is soil lost forever from the land. Fossil water, accumulated underground thousands of years ago, is being used by burgeoning populations of humans much faster than it is replaced. All this means that the health of our waterworld will be a key subject in the century ahead.

To understand the bases of our civilization, exhibits on the history of human uses of water, on our technologies for agriculture, on our epic ocean voyages, sea battles, explorations, and underwater discoveries all belong in the new trail: **waterworld, cradle of life and precious resource.**

We are designing the trail as a chain of units, pearls on a string. At the Rock Creek end of Olmsted Walk, an introductory module will act as a gateway or overture to the rest. It will highlight themes such as the history of water and land, and the role of water in shaping the earth's surface. It should explore the physics and chemistry of water in its forms of steam, ice, and liquid. Relating the details of life in water and water in life is essential, as is the many ways that animals and plants are adapted to life in water, and how they use it when they live on land. The stories of water in human history and our present uses and abuses of water, including the history of our explorations of water both through the microscope and in voyages of discovery, can be made exciting in a variety of media. All this should constantly emphasize how we can conserve and preserve our priceless water heritage. These themes will be amplified and embroidered as the trail extends. The first themes will be on the path to Amazonia, where a new pond will be built in the meadow. We hope to have a periscope looking into the pond to see an array of fishes. Amazonia with its spectacular tropical fish exhibits and the great Earth globe further complements the trail. The globe and the interactive satellite videos show the great rivers and lakes of the world, the yearly patterns of global rainfall, and where the oceans' depths and peaks are. From there the path winds up the valley.

Onwards there will be a medley of existing and new exhibits. We plan modules comparing water mammals and submarines, and to produce an Earth globe with its south pole uppermost to

show the water hemisphere. We plan exhibits on the uses of water in the human body, and a review of diseases that are transmitted through water. We expect to involve industries and organizations that use water to help produce exhibits on purification, conservation, and the recreational uses of water. They will help explain how to preserve America's unique water wonders. In the process, we expect to upgrade the exhibits along Beaver Valley, making them better, more exciting, and at the same time fixing maintenance problems.

What about new species, more animals? Of course we need exciting animals doing interesting things to further our educational programs. Aquatic animals are particularly good for stimulation. They are usually very attractive because they have a high level of activity; most of them swim for long periods of the day. Capturing attention and stimulating curiosity is the important first step in expanding biological knowledge. Unfortunately, adding to our animal collection is impossible if we can't expand our animal care staff. At this stage we will need to make existing exhibits more stimulating and, wherever possible, easier to run. Then, we, at every stage, must make provision for the *future* expansion of the range of *living* exhibits. We expect to be able to accomplish this when our present downsized animal care staff can finally be expanded. Among the new animals we would eventually hope to add are penguins, sea otters, lake fishes, and perhaps anhingas, also called snake birds. Then there are all kinds of animals that reflect research at the Smithsonian, such as sea snakes, which are the subject of extensive studies at the Smithsonian Tropical Research Institute in Panama. And of course we will not forget aquatic plants. Some wetland plants are crucial to the economy of the world and have played a significant part in the history of this country. For example, an exhibit on rice, and its paddy cultivation, would teach a lot. It has had a profound effect on the cultural history of South Carolina that is not widely known. The connection between cotton and water is also a story to be told. Not only its past, but its present is full of stories. As a son of Lancashire, on the Irish Sea, in Northwest England, I learned a cotton story first hand. In the early part of this century, it was said that: Britain's bread hangs on Lancashire's thread. The cotton mills that surrounded my youth and are the subject of the paintings of L. S. Lowry, a Manchester artist whose works now hang in Britain's National Gallery, were built in rainy regions, where ports faced the Atlantic to receive American raw cotton. Spinning and weaving needed high humidity.

The new and upgraded features should excite, educate, and inspire and be a fitting complement to the new exhibits on Olmsted Walk. Of course, to realize this dream will necessitate fundraising to supplement an existing federal appropriation for the "Living in Water Exhibit." Our development office is hard at work, and there have been surprisingly positive responses from a wide range of people. It looks as though we have chosen a subject that raises widespread concerns among a wide range of our fellow Americans.

Michael H. Robinson is the Director of the National Zoo.

Killer Cultures

Robin Meadows

Photography: © Kelley Balcomb-Bartok



The killer whale's range extends across the globe, but scientists are finding that behavior and diet varies from place to place.

Killer whales stun seals by lobbing them into air with their tail flukes, force sea lions under water until they drown, and throw themselves over other whales' blow holes presumably to keep them from breathing. Consummate predators, killer whales are the tigers of the seas.

Their combination of intelligence and relentlessness has made killer whales feared through the ages. In the first century A.D., Roman scholar Pliny the Elder described them as "an enormous mass of flesh armed with savage teeth." The perception of killer whales as dangerous beasts prevailed. As recently as 1973, U.S. Navy diving manuals still erroneously cautioned that killer whales "will attack human beings at every opportunity." Even their taxonomic name *Orcinus orca* inspires dread: *Orcinus* means "belonging to the realms of the dead" while Orcus was the Roman god of the underworld.

Over the last 25 years, however, biologists have discovered that killer whales possess another side. Resident killer whales in the Pacific Northwest live in close-knit, matrilineal families that have strong ties to related families—a social structure likened to that of human tribes and clans by Kenneth Balcomb of the Center for Whale Research in Friday Harbor, Washington. "The complexity of killer whale societies is paralleled only by the societies of elephants and higher primates, including humans," agrees Sara

Heimlich-Boran, a biologist who studied killer whales in Washington state during the 1980s and co-authored the book *Killer Whales* (1994, Voyageur Press).

KILLERS ON THE MOVE

Killer whales are among the widest-ranging mammalian species, living in all the world's oceans. While the size of the total population is unknown, their numbers are greatest in the cooler waters near coasts and continental shelves at mid-to-high latitudes. These areas are rich in the whales' preferred prey.

Opportunistic feeders, killer whales will eat a wide variety of prey ranging from squid and sea turtles to birds and deer or moose that swim narrow coastal channels. However, they tend to specialize in locally abundant fish or marine mammals.

In the Pacific Northwest, some killer whales follow salmon runs, splashing their flukes and flippers to herd the fish against the shoreline. In Norway, killer whales swim in circles around the schools of herring that spawn in the fjords, flashing their white bellies to disorient the foot-long fish and slapping the water with their tail flukes to stun and kill them.

Killer whales divide their time between resting, socializing, and hunting and traveling as far as 50 miles a day in search of prey. They vocalize almost constantly while traveling and hunting for





An orca breaches, temporarily leaving its watery realm.

fish, making more than 50 repetitive, high-pitched calls a minute. Audible for at least five miles under water, these calls are thought to coordinate the movements of individual whales. In contrast, killer whales are nearly silent while hunting marine mammals, forgoing even echolocation clicks. While these clicks would help killer whales find prey, they would also alert the intended victims to the whales' presence. Instead, marine-mammal-hunting killer whales appear to rely on "passive sonar"—sounds made by the marine mammals themselves—and spyhopping, which entails thrusting the upper body straight out of the water as if to scan the surface.

Killer whales often forage at seal breeding rookeries. They arrive at the Crozet Islands, near Antarctica, and at the east coast of Argentina just in time for the seal pupping seasons. Southern elephant seals breed on the shores of Argentina in October and southern sea lions breed there in January. The steady supply of pups has allowed local killer whales to perfect the art of snatching them off the steep pebble beaches. This potentially dangerous maneuver entails intentionally stranding themselves.

Sometimes aided by another pod member that swims blatantly in front of the seals to distract them, a hunting killer whale swims swiftly along the shore. After building up enough speed, the whale abruptly turns, lunges onto the beach, and seizes a pup. Shaking its prey vigorously, the whale pivots oceanward and returns to the water with the next wave. Once safely back in the ocean, the whale may release the seal pup so calves can practice catching it.

After foraging, killer whales often rest but their version of sleep is nothing like our own. Members of a pod cluster tightly, usually around their mother, diving and resurfacing rhythmically as they breathe in unison. Because whales sink if they don't swim, pods swim constantly even while resting, gliding along leisurely at speeds of just over one mile per hour. Sometimes one or two killer whales stay awake to guide the resting pod around rocks and other obstacles. Killer whales rest for an average of only two hours at a time, and biologists believe that these cetaceans are as active throughout the night as they are during the day.

Resting is often followed by boisterous bouts of socializing and playing, and juveniles are likely to play even while the rest of the pod is foraging or resting. Killer whales at play are exuberantly vocal and active. In contrast to the repetitive calls made when hunting fish, social sounds vary from pure-tone whistles to squeals, squawks, and screeches. Individual killer whales sometimes surf in the wakes of boats or play with kelp, draping the long strands of seaweed over their dorsal fins or lifting them in the air with their tail flukes. Swimming as fast as 20 miles per hour, groups of killer whales chase each other, roll and thrash around at the surface, and dive together. They also engage in lots of aerial displays: tail and flipper slapping, spyhopping, and breaching (leaping out of the water).

A TALE OF TWO TRIBES

Although killer whales may appear identical, a closer look reveals subtle physical differences among individuals. Notably, the dorsal fins of some killer whales point almost straight up while others curve back. In addition, each whale has a characteristic pattern of black-and-white markings on its saddle patch, the area just behind the dorsal fin.





Killer whales are opportunistic feeders, but they tend to specialize in locally abundant fish or marine mammals.

Taking advantage of these differences, biologists studying killer whales off British Columbia in the early 1970s began to identify individuals based on the size and shape of the dorsal fin, the saddle patch pattern, and any nicks and scars. By taking photographs of the killer whales encountered during their summer observations, biologists have built up catalogs of known individuals. Today the total known killer whale population in the Pacific Northwest including Alaska is about 1,000.

The ability to track the behavior of individual killer whales has led to several surprising discoveries. By the early 1980s it was clear that the coasts of British Columbia and Washington state are home to two populations that share the same waters but lead completely separate lives. Dubbed “transients” and “residents,” these populations have never been observed to interact in the more than 20 years they have been followed.

The underlying difference between the two populations is that they specialize in different prey: Transients eat primarily marine mammals while residents prefer salmon. Hunting these types of prey requires vastly different techniques, which in turn has led to widely divergent social structures. The two types also have a small morphological difference: Transients’ dorsal fins tend to have sharp points while those of residents tend to be rounded.

The 170 known transient killer whales in the Pacific Northwest have a fluid social structure and their whereabouts are unpredictable. Pods typically have fewer than 10 individuals and may contain varying combinations of adults and young. Adolescents often leave after the birth of a younger sibling, and adult males often travel alone. Seen from the coastal waters of Mexico to the Bering Sea, transients roam bays, small coves, and channels in search of harbor seals, sea lions, and porpoises.

In contrast, resident killer whales have a remarkably stable social structure and travel along predictable routes as they follow salmon runs. Males and females alike spend their entire lives in the pods in which they were born. Ranging in size from six to 50 or more, pods are matrilineal and can include mothers, grandmothers, and even great-grandmothers.

The 305 residents off British Columbia and Washington state are further divided into two populations that, like transients and residents as a whole, have never been seen to interact. Separated by the Campbell River estuary, the 95 “southern” residents live from Puget Sound to the southern half of Vancouver Island. The 210 “northern” residents live from the northern half of Vancouver Island to the tip of the Alexander Archipelago, in southernmost Alaska. In addition, the waters off Alaska are home to another 300 or more resident killer whales tentatively divided into five populations living in southeastern Alaska, Prince William Sound, Kodiak Island, the Aleutians, and the Bering Sea.

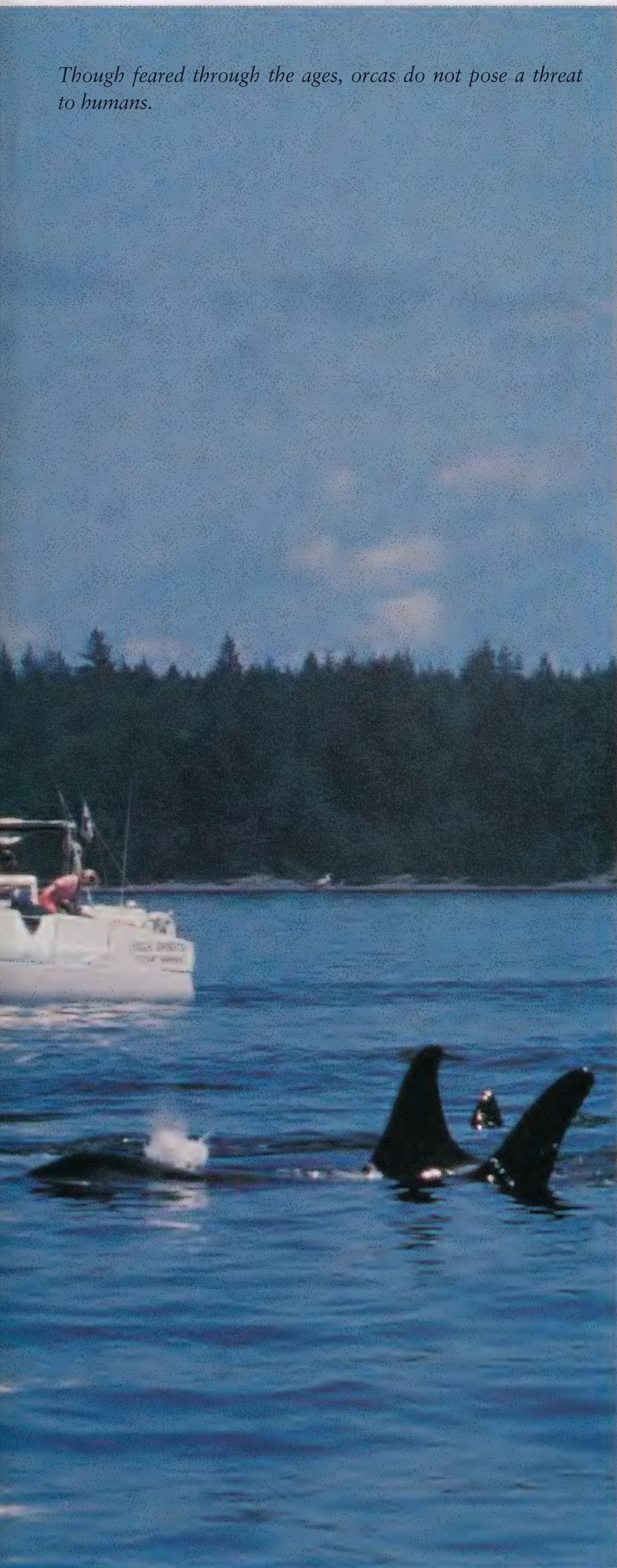
DECIPHERED DIALECTS, MYSTERIOUS “OFFSHORES”

Besides having fundamentally different social structures, resident and transient populations speak different languages. Like birds, killer whales make a variety of calls.

Unlike the songs of most birds, however, killer whale calls consist of “high-pitched squeals and screams not unlike the sounds made by rusty hinges on a quickly closing door,” says John Ford of the Vancouver Aquarium and his co-authors in *Killer Whales: The Natural History and Genealogy of Orcinus orca in British Columbia and Washington State* (1994, University of Washington



Though feared through the ages, orcas do not pose a threat to humans.



Press).

Known as discrete calls, each one of these vocalizations has a characteristic pattern of pitch and timing. The various populations of killer whales have their own repertoires of discrete calls, or dialects. Some of these dialects are so distinct that people can hear the differences just by sticking their heads under water and listening.

In support of biologists' belief that transients and residents never interact, there is no overlap between their dialects. That is, transients don't use any of the discrete calls made by residents and vice versa. Furthermore, all transients have the same basic dialect, using four or more of six shared discrete calls, which makes sense given their fluid social system. Similarly, in keeping with their structured society, each resident pod off British Columbia and Washington state has its own dialect of between seven and 17 discrete calls.

As if killer whale societies weren't complex enough, a third type was discovered in 1991. Called "offshores" for their habit of frequenting continental shelf waters some 15 to 25 miles off the coast, this little-known population may range hundreds of miles out to sea and individuals have been seen from southern California to the Bering Sea. Offshore pods contain 30 to 60 individuals and the total population is estimated at 200 or more. Like residents, offshore killer whales have rounded dorsal fins and probably eat fish. However, preliminary analysis suggests that offshores use a unique dialect.

The offshores could be the key to answering one of the biggest questions about residents. In other species that live in multi-generation, matrilineal societies, males usually disperse when they reach sexual maturity. But with both male and female residents staying with their mothers, how do they avoid inbreeding? The Center for Whale Research's Kenneth Balcomb speculates that they may interbreed with the offshore killer whales, as both northern and southern residents occasionally swim offshore.

EYES ON THE GENES

Much of what we have learned from killer whale behavior has been confirmed—and extended—by recent genetic analyses of the Pacific Northwest populations. The genetics work was done by molecular ecologist Rus Hoelzel of the University of Durham, England, Marilyn Dahlheim of the National Marine Mammal Laboratory in Seattle, and Jonathan Stern of the Marine Mammal Research Program, Texas A&M University, Galveston. The researchers analyzed the DNA from the skin and teeth of killer whales that died from stranding, and from skin samples collected by biopsy dart from free-ranging killer whales. Each of 50 killer whales was classified as a resident or a transient: Free-ranging whales were classified according to photo identification and behavior, and dead whales were classified according to their stomach contents (fish versus marine mammals).

The results confirmed Hoelzel's previous finding that there is a highly significant degree of genetic variation between residents and transients. The data suggest that the two populations began to evolve separately about two million years ago and that they have not interbred for about 100,000 years. Hoelzel and his colleagues believe that the resident and transient populations' behavioral isolation resulted in their genetic differentiation. Moreover, residents and transients in the Pacific Northwest may be on their



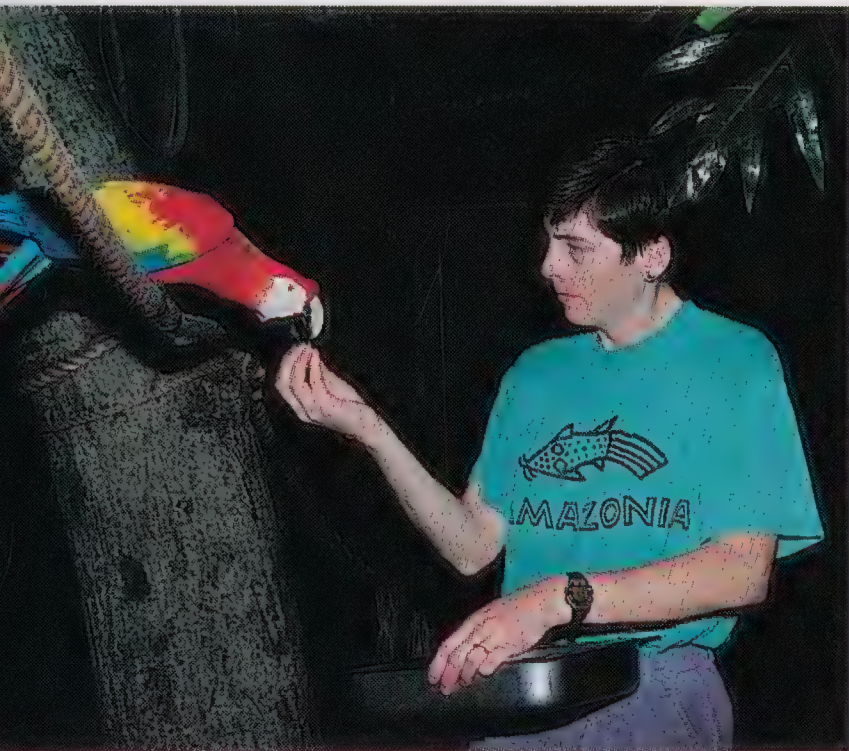
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BEHIND THE SCENES AT AMAZONIA:

Working the Urban Jungle

As they roam around the re-created rainforest of Amazonia, visitors can peek into the field station of a fictitious research scientist, Dr. Brasil. The elusive doctor always seems to have just left, venturing out into the field while visitors stay behind to peer at his tanks of specimens and peruse tacked-up newspaper articles about the most recently discovered species of the Amazonian rainforest. The field station is always full of new information and meticulously laid

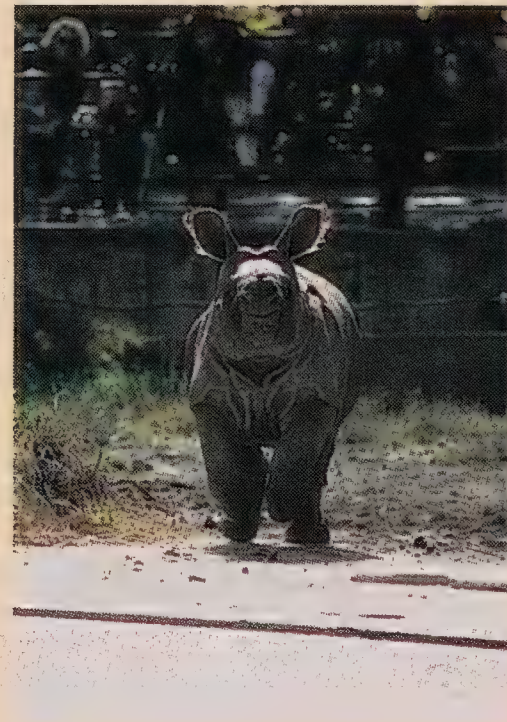


out—so much so that you would swear someone really is spending hours each day there. That “someone” is the exhibit’s staff. Keepers, those animal lovers in shorts and hiking boots, are the real Dr. Brasils, setting up the field station in the early

mornings for each new day of visitors.

Amazonia’s lush forest requires constant attention and keepers are always on the move. “So many of our activities are out in the public,” explains Amazonia keeper Blake Rushin. Whether they are hanging over walls to pull away dead leaves clogging water filters, balancing on rocky ledges to lower bundles of lettuce and other vegetables into the simulated river for large schools of tropical fish to nibble on, or rappelling down walls to clean the acrylic tank-view windows, keepers often find themselves part of the exhibit as well.

continues on page 2



NEW IN 1997

Don’t miss baby rhinos Chitwan and Himal, born in the fall of 1996.

Speke’s gazelles, with snouts built for snorting, are among the Zoo’s newest species. Look for babies, too.

The Zoo’s American bison have moved to the outdoor exhibit across from Lot A, and Bactrian camels have moved to the former bison area next to the Small Mammal House during the construction of Grasslands.

See the new Amazonia Science Gallery, where learning has never been so much fun.

Check out the fabulous Wildlife Walls around the Lion/Tiger exhibit, then ask at any information station how your name can linger at the Zoo long after you’ve gone home.

BLAST FROM THE PAST

During World War II, all of the Zoo’s venomous snakes were sent to zoos in the middle of the country. Officials feared the snakes would escape and threaten human lives if the capital were bombed.

Join FONZ Today!

Ask at any information station or gift shop about the benefits of being a member of Friends of the National Zoo. If you join, right away you’ll park free and enjoy a 20-percent discount in the shops. Plus, you’ll receive six stunning issues of *ZooGoer* in the next year. And that’s just the beginning. From out of town? Ask about FONZ’s special membership for far-flung friends. Call 202.673.4961 for more information.



JUMBO-SIZED MEAL

An elephant alone may eat up to 175 pounds of food—hay, fruits, and vegetables—each day!

ANIMAL EVENTS AT THE NATIONAL ZOO

(Daily unless otherwise noted.)

- 10:30 a.m. Marabou Stork Feeding
Outside yard, behind the Bird House
- Elephant Foot Care
Outside the Elephant House
(inside in inclement weather)
- 11:00 a.m. Giant Panda Feeding
Outside yard at Panda House
- Meet-a-Kiwi (Monday/Wednesday/Friday)
Outside yard at Bird House
(inside in inclement weather)
- Aldabra Tortoise Feeding
Outside Reptile Discovery Center;
from mid-May through June
- Orang utans leave Great Ape House for Think Tank via the O-line cableway. This is the best time to see them, though they come and go from 11 a.m. to 2 p.m.
- 11:15 a.m. Meet a Flamingo Keeper (Monday through Friday)
In front of flamingo exhibit
- 11:30 a.m. Elephant Training
Outside the Elephant House
(inside in inclement weather)
- Sea Lion Training
Sea Lion Pool
- 1:00 p.m. Brown Pelican Feeding
Wetlands Exhibit

SUNSET SERENADES

Top off your day at the Zoo with a mellow evening of music! Every Thursday from June 26 through August 7, you can sit back on Lion/Tiger Hill and enjoy a free concert featuring music from Celtic folk to Jamaican reggae and rock 'n' roll. The outdoor concerts run from 6:30 to 8:00 p.m. unless interrupted by rain, and the Mane Restaurant is open for refreshments. Ask at any Information Station to find out who's on the schedule, or call 202.673.4717 for information.

Keepers play a variety of roles in Amazonia, from animal handler to teacher and tour guide. They answer questions about plants and animals, point out shy or camouflaged animals to visitors, and guide children and adults through Dr. Brasil's research station. "We don't have labels on plants; we have people out there to talk about

them," says Rushin. "That was a choice." In addition to keepers, Amazonia also has specially trained FONZ interpretive volunteers who roam the exhibit in order to help visitors see the often hidden creatures.

Keepers work with the public most at Dr. Brasil's field station, where visitors often raise questions while they come face to face with piranhas, red-footed tortoises, and dart-poison frogs.

Keepers find that their role as educators is necessary in Amazonia—though the exhibit is filled with information, very little of it is obvious to the untrained eye. "Since this is a habitat exhibit, to maximize your view of

continues on page 3



SILVER ANNIVERSARY

The Zoo is celebrating the 25th anniversary of the arrival of Hsing-Hsing, our male giant panda, at the National Zoo. Along with Ling-Ling, who died in 1992, Hsing-Hsing was a gift from the People's Republic of China.



animals you need to look for them a little harder. If you're used to doing birding outdoors, you'll enjoy it," says keeper Ed Smith. "Otherwise you

might find it frustrating, because the sloth might be sleeping under some leaves and then you don't see anything. So, take your time." Amazonia also comes equipped with detailed "field guides" hanging from railings; zoogoers can try to identify which of the twelve or so bird species—hummingbirds, honeycreepers, tanagers, sunbitterns, and red-crested cardinals—they see flitting through the foliage or streaking past.

Keepers enjoy their interaction with zoogoers, but they also cite working in a mixed-species exhibit as a major Amazonia attraction. "The nice thing about working with a mixed-species exhibit is you really do learn about all different types of plants and animals," says Ed Smith. And while every keeper has his or her own area of expertise—Rushin works primarily with fish, keeper Melanie Pyle primarily with plants, and so on—everyone eventually learns to do everybody else's job. "It's like being a jack-of-all-trades," notes Supervisor Vince Rico.

All seven Amazonia staff have volunteered or worked in other exhibits before and recognize how different Amazonia is. Amazonia is the most species-rich exhibit at the Zoo, housing not only mammals, birds, and reptiles, but more than 2,600 fish. With more than 350 plant species, the Amazonia exhibit also houses the Zoo's greatest botanical collection.

By working largely with plants and fish and filtration devices, Amazonia keepers don't always have the same personal connection with the animals they might have working with elephants or other large mammals. Amazonia's Goeldi's and titi monkeys have managed to make some personal

continues on page 8

EXHIBIT ROUNDUP

LION/TIGER EXHIBIT

Divided into three hilly enclosures, this exhibit houses the Zoo's Bengal and Sumatran tigers and one female and two male lions. Cats are rotated on and off the exhibit, so one day you might see Bengal tigers with regular orange and black coloring, while the next day, the white tiger might be out.

AMAZONIA

More than 350 plant species thrive in this indoor rainforest. Scan the shadows and dripping foliage for Goeldi's and titi monkeys, a sloth, tropical tanagers and honeycreepers, and listen for the high-pitched calls of dart-poison frogs. The Amazonia Science Gallery, the Zoo's newest exhibit, is attached to the rainforest. Here visitors can explore how science is constantly honing our views of the natural world, and meet scientists who are working in the Gallery's labs.

REPTILE DISCOVERY CENTER

Voted outstanding brick building in the eastern United States in 1931, this is the home of a variety of lizards, snakes, turtles, and crocodiles, some amphibians, and interactive activities that let kids understand why reptiles and amphibians do the things they do. Look around the back of the building for Komodo dragons, alligators, and other crocodiles, as well as the entrance to the Invertebrate Exhibit.

INVERTEBRATE EXHIBIT

From one-celled organisms to intelligent octopuses, this exhibit displays greater animal diversity than any other Zoo exhibit. Here you can spy on a leaf-cutter ant colony, examine tiny animals in samples of local soil, check out live corals and sea stars, and get close-up views of many other odd-looking creatures. At the end of the exhibit is Pollinarium, an exhibit on plants and the animals that pollinate them. Walk indoors amid flowers that bloom year round and watch the butterflies and hummingbirds that visit them. You can also view the year-round activities of a hive of honeybees, visible behind

continues on page 6

SMALL BUT DEADLY

Tiny dart-poison frogs produce some of the deadliest poisons known. Just 0.00000007 ounces of skin secretion from the most poisonous of these frogs is enough to kill you. Look for dart-poison frogs in the Reptile Discovery Center, but don't touch!

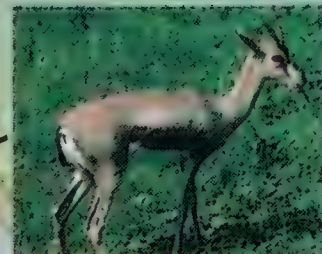




Cheetah



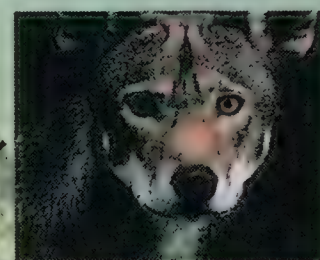
Grevy's Zebra



Speke's Gazelle



Giant Panda



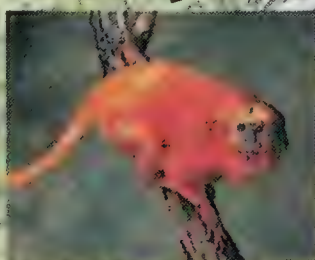
Red Wolf



Nene



Greater One-horned Asian Rhino



Golden Lion Tamarin



Spectacled Bear

RARE FINDS

Some of the world's rarest animals live at the Zoo. Here's a map showing where you can find them and an estimate of how many are left in the wild. For comparison, we show one of the world's most abundant species—also seen at the Zoo!

1.	Red Wolf	50-100*
2.	Rare Island Birds	
	Bali Myna	100-200
	Guam Rail	extinct in wild
	Nene	350
3.	Black-footed Ferret	<500*
4.	Sumatran Tiger	500
5.	Golden Lion Tamarin	700**
6.	Giant Panda	1,000
7.	Speke's Gazelle	1,000
8.	Cuban Crocodile	2,000
9.	Greater One-horned Asian Rhinoceros	2,000
10.	Komodo Dragon	4,000-5,000
11.	Grevy's Zebra	6,000
12.	Cheetah	9,000-12,000
13.	Spectacled Bear	10,000
14.	Orang utan	5,000-10,000
15.	Human	5,700,000,000

*Was extinct in the wild; these are reintroduced animals.

**Includes wild and reintroduced animals.

THE ZOO'S HIDDEN TREASURES

Tips for finding Zoo animals and plants off the beaten path:

BEHIND THE BIRD HOUSE

Follow the path around the left side of the Bird House to see some of the world's largest birds: five crane species, cassowaries, kori bustards, rheas, goliath herons, and others.

GOLDEN LION TAMARIN TRAINING GROUND

Along a quiet path through the woods, between the Elephant House and Beaver Valley, summer visitors will find a pair of golden lion tamarins roaming free. Volunteers carefully watch these primates, which are trainees for release back into their Brazilian dry forest habitat.

FOREST CARNIVORES

Between the prairie dogs and the police station, a winding path takes you to enclosures housing the bobcat, a weasel-like cat called the jaguarundi, a western African mongoose called the cusimanse, and raccoon-like coatis.

SERVALS AND LEOPARD

Most visitors check out Lion/Tiger Hill, but not all take the short path adjacent to this exhibit to see the lanky servals and the leopard, which live in enclosures amid bamboo and other dense foliage.

DEER YARDS

Troop up the path behind the bongo yard for a great view looking down at these striped antelope. The path leads to one of the quieter corners of the Zoo, where shy Burmese brow-antlered deer, also known as Eld's deer, live. You can also enter the back of the Outdoor Flight Exhibit from this path and walk through this exhibit to the Bird House.

THEME GARDENS

The Zoo's theme gardens highlight plants that are important to humans and animals alike. These include: the American Indian Heritage Garden (beside the Small Mammal House); the African American Heritage Garden (beside Gibbon Ridge on the Great Meadow); and a butterfly garden (behind the Reptile House).

SPEKE'S GAZELLE

Easily missed by visitors entering the Zoo from the top or bottom of the hill, a path leads past one of the Zoo's newest mammal residents, the rare Speke's gazelle from northeast Africa.

BAT CAVE

Indoors at the Lion/Tiger Exhibit, you can see two kinds of bat and blind cave fish.



HEY, BUFFALO BILL

In 1904, Buffalo Bill Cody left a small herd of buffalo—now more accurately called bison—at the National Zoo.



Humans



Orang Utan



Komodo Dragon



Cuban Crocodile



Sumatran Tiger



ZOO BABIES

Spring and summer is the best time for Zoo babies. Among the expected arrivals for 1997 are a baby lowland gorilla in April or May, a baby giraffe during the summer, and a baby Speke's gazelle. Check the Reptile Discovery Center and Small Mammal House, where babies are almost always on exhibit. Also, pygmy marmosets (Small Mammal House and Great Ape House) and prairie dogs (near Mane Restaurant) often have babies in late spring and summer.

panes of clear acrylic. Open Wednesday through Sunday.

CHEETAH CONSERVATION STATION

A total of six cheetahs live at this exhibit, but they do not stay in the same place. They are regularly rotated from enclosure to enclosure so they get a change of scenery. The grassy enclosures simulate the African plains, and the cheetahs often use the hilly vantage points to look down on their keepers. Females live alone, while males live in two-cat coalitions as they do in the wild.

BIRD HOUSE/WETLANDS EXHIBIT

The Wetlands Exhibit outside the Bird House is home to representatives of more than one-third of the world's duck species, and many other kinds of water birds. Wild Cooper's and red-shouldered hawks occasionally buzz low over the ducks. Inside the Bird House is a simulated jungle with free-flying tropical birds. Beside the Bird House is the impressive Outdoor Flight Exhibit, home to birds of the woods and waters of the Americas.

GREAT APE HOUSE

Be sure to check the large ficus trees just inside the front door for free-ranging pygmy marmosets. From the Great Ape House, orang utans climb the green tower and "commute" to Think Tank. Follow the path behind the Great Ape House to see the lowland gorilla family relaxing in their outdoor yard.

THINK TANK

One of the newest Zoo exhibits, Think Tank explores animal intelligence and behavior. Watch the fascinating interactions between members of a Sulawesi crested macaque group and between Zoo staff and the orang utans that visit the exhibit via the O-line cableway.

SMALL MAMMAL HOUSE

From brightly colored Prevost's squirrels to bushbabies and sluggish sloths, the Small Mammal House is full of surprises. Birds, reptiles, and mammals live side by side in a few of the building's exhibits. Outside, a cactus garden adorns the side of the building facing the Great Ape House.

ELEPHANT HOUSE

When this building first opened in October 1939, it housed four giraffes, a black rhino, Asian and African elephants, and Nile and pygmy hippos, as well as Malayan tapirs, huge wild cattle called gaur, and Cape buffalo. Now,

continues on page 7

animals enjoy larger enclosures, and golden-headed lion tamarins climb through the planters and across the ledges above the pygmy hippos' indoor exhibit.

BEAVER VALLEY

Watch for a variety of wild songbirds around the waterfall and a surprise dinosaur in this well-wooded area, where the Zoo's beavers, white-tailed deer, and red wolves live. Travel farther down the trail and you will come to the gray seals and California sea lions, the bears, and finally the Amazonia Exhibit and Science Gallery.



THE BIOPARK: A WILD PLACE

One goal of the Zoo as a "biopark" is to provide habitat for wild animals and a good environment in which people can learn about the natural world. The Zoo has been carefully landscaped to provide food and shelter for a variety of urban wildlife. Instead of many large grassy areas, you will find ponds, flowers, berry-bearing bushes, and mixed groves of trees. You will undoubtedly see some of the Zoo's wild residents: tiger swallowtails and monarchs visiting rusty-purplish joe-pye-weed blossoms, canary-yellow goldfinches prying seeds from purple coneflowers, scampering chipmunks and gray squirrels of both gray and black color phases, wild wood ducks mingling with the Zoo's ducks at Wetlands, and a variety of hawks and woodpeckers. In spring and summer, hundreds of black-crowned night-herons nest in the trees around the Bird House and Wetlands Exhibit. White-tailed deer regularly wander into the Zoo in the early hours from adjacent Rock Creek Park.

STRANGE NAMES GOT YOU STUMPED? HERE'S HELP!

(Illustrations are not to scale.)



caiman: South American crocodile cousin. (Behind Reptile Discovery Center.)



gharial: Thin-snouted, fish-eating crocodilians from India and Bangladesh. (Reptile Discovery Center.)



mata mata: A large, bizarre-looking South American turtle. (Reptile Discovery Center.)



bongo: A large striped African antelope with long, curved horns. (Near Visitor Center; shares exhibit with Marabou storks.)



hammerkop: Wedge-shaped "hammer head" gives this African wading bird its name. (Bird House.)



garganey: Migratory Old World duck. (Wetlands Exhibit.)



seriema: Tall long-legged bird of southern South America. (Behind Bird House.)



kori bustard: An African grassland bird, one of the heaviest flying birds. (Behind Bird House.)



i'iwi: A small scarlet, black, and white forest bird from Hawaii. (Bird House.)



nene: Hawaii's state bird, a native goose. (Wetlands Exhibit.)



screamer: Primitive duck relative, native to South America. (Wetlands Exhibit.)



smew: Black-and-white Eurasian duck. (Wetlands Exhibit.)



tapir: A burly, long-nosed relative of horses and rhinos, native to Malaysia. (Across from Visitor Center; shares exhibit with muntjac.)



muntjac: A small, primitive deer, native to Asia, also called a barking deer.



cusimanse: A kind of mongoose from West Africa. (Small Mammal House.)



mara: Maras look a bit like rabbits but in fact are large South American rodents. (Near Gibbon Ridge.)



kowari: About the size of an eastern chipmunk, these carnivorous marsupials with long tails are from Australia. (Small Mammal House.)



saki: A long-haired, long-tailed South American monkey with white to reddish markings on its face. (Amazonia.)



Jan Dusing

MINIATURE MONKEYS

The world's smallest primates, South America's pygmy marmosets would fit comfortably in your hand and their babies can cling to just one finger. Look for these tiny monkeys in the Great Ape House.

WORD FIND

L	B	O	N	G	O	D	P	A	R	H	Y
X	S	G	A	R	G	A	N	E	Y	L	K
A	M	E	I	R	E	S	T	A	Z	S	O
T	H	C	G	J	L	A	S	F	B	C	R
A	A	U	W	M	E	K	O	W	A	R	I
M	M	S	M	G	R	I	I	W	I	E	B
A	M	I	U	H	H	K	Q	U	D	A	U
T	E	M	N	A	M	I	A	C	P	M	S
A	R	A	T	R	O	W	L	S	A	E	T
M	K	N	J	I	G	E	H	M	A	R	A
Y	O	S	A	A	V	M	T	A	P	I	R
C	P	E	C	L	O	S	N	E	N	E	D

Find these animals with strange names:

BONGO	I'IWI	NENE
CAIMAN	KORI BUSTARD	SAKI
CUSIMANSE	KOWARI	SCREAMER
GARGANEY	MARA	SERIEMA
GHARIAL	MATA MATA	SMEW
HAMMERKOP	MUNTJAC	TAPIR

impressions, however, as has the exhibit's scarlet macaw, Mac. "He can say hello in maybe twenty different subtexts," marvels Smith. "He has these begging, pleading hellos, he does a query hello—it's the same thing we do when we walk into a house."

Although they work hard out in the exhibit, Amazonia keepers find that most of the work is, in fact, behind the scenes. "Visitors always ask if Amazonia is a 'balanced environment,'" says Ed Smith. "If it's at all balanced, that's only because we keep tweaking it." Keepers not only spend a large portion of their time cleaning tanks and filtering out the fish's water, they also spend two hours every morning hosing off Amazonia's plants to rid them of insect pests, and they regularly prune tree limbs to keep the plants from overcrowding.

Careful attention is lavished upon the foliage because pesticides and herbicides, which would likely harm the animals, cannot be used. Keepers also monitor the animals' eating patterns and behavior, making sure to keep the entire Amazonia staff up to date by leaving notes about individual animals on a large dry-erase board.

Amazonia keepers may be out in the open, right there for visitors to watch and question and learn from, but they are also there in the background, doing what keepers always do—making sure everything runs smoothly and seamlessly, making it seem as if there were no planning at all, so that both Zoo animals and Zoo visitors can fully enjoy Amazonia.

—Debra Solomon



Photos for this issue of Do The Zoo '97 by Jessie Cohen/NZP.

New insights into orca behavior and habitat needs will help people and whales coexist more harmoniously in the future.



way to becoming separate species, says the Vancouver Aquarium's John Ford.

Hoelzel and his colleagues also discovered that there is a small but significant genetic difference between the southern and northern residents in the Pacific Northwest. Intriguingly, the southern residents and offshores were genetically similar in this analysis, as were the northern British Columbian and Alaskan residents.


These genetic differences and similarities can be used to trace a genealogy of the resident populations. The biologists believe that the southern residents descended from one founding stock of killer whales thousands of years ago, and that the northern residents are the descendants of another founding stock. "[The] evidence suggests that resident killer whales derived from founding matrilineal populations in each of the resident ranges, perhaps in a way analogous to human kinship groups radiating into coastal habitats as ice retreated from the Pacific Northwest [thousands of years ago]," says Balcomb in a 1996 report to Earthwatch, which helps fund his work. Alternatively, the southern residents could have descended from the northern residents, or vice versa.

The genetics work also has important conservation implications. Since killer whales came to live in the coastal waters of the Pacific Northwest, their environment has changed greatly. In particular, the human population has grown tremendously. Local killer whales are threatened by the potential for oil spills, the major shipping lanes that cross their habitat, and the drastic reduction of salmon runs. Knowing that there are genetically distinct populations of killer whales will help ensure that we share our waters with all of them.

Robin Meadows is a contributing editor to ZooGoer.

KILLER WHALE VITAL STATISTICS

The largest members of the dolphin family, killer whales can reach lengths of up to 31 feet. However, the typical adult male is 21 feet long with a six-foot dorsal fin, and weighs about 9,000 pounds. Adult females average 20 feet long with three-foot dorsal fins and weigh about 6,000 pounds. Both males and females reach sexual maturity in their early- to mid-teens, and females give birth every three to eight years of their 25-year reproductive life span. Gestation takes a whopping 17 months, and newborns are about eight feet long and weigh about 400 pounds. After nursing for a year, a mother killer whale continues to tend her calf solicitously for several more years.



A STORM IS BREWING OVER OUR OCEANS

Carl Safina and Mercédès Lee

Oceans were the birthplace of life on Earth, and they harbor a bewildering array of life forms. The seas have long seemed endless and infinitely bountiful. But overfishing and habitat destruction are taking their toll, and marine depletions are causing ecological upheaval, human conflict, and impoverishment.

Overfishing: Clear-cutting Our Oceans

The frontal assault that is most directly threatening marine life is overfishing, the clear-cutting of our world's oceans. Technological advances over the past few decades—sonar, radar, satellite-assisted fish finding, huge factory ships that spend months at sea, and nets large enough to envelop a football field—have changed the fundamentals of fishing. Exacerbating these overwhelming assaults is the pressure of more and more boats chasing fewer and fewer fish. The result is that in many parts of the world, fish populations are at historic lows.

Fish such as Atlantic salmon, Newfoundland and New England cod, halibut, haddock, and flounder, have been driven to commercial extinction. Their numbers are so low that it is no longer profitable (or legal) to fish for these species in large parts of their range. And migratory giants such as tunas, swordfish, marlin, and sharks are facing a similar fate.

For instance, the adult population of Atlantic giant bluefin tuna off the U.S. east coast has fallen more than 85 percent since the 1970s, but because they are worth tens of thousands of dollars

apiece for sushi in Tokyo, catch quotas have recently been increased. The breeding population of Atlantic swordfish is only about 20 percent of what it was 15 years ago, and 90 percent of swordfish are now caught before they reach breeding age. Many shark species in the U.S. Atlantic and Gulf of Mexico have declined 70 to 80 percent in the last decade due to excessive fishing pressure. The good news here is that the U.S. government has proposed cutting shark fishing allocations in half, and if implemented, this could halt their current decline.

Instead of living off the biological interest of wild populations, we have mined—rather than managed—the capital. The emphasis—in thinking, in politics, and in fisheries law—has been on economics over biology. Ironically, overemphasis on short-term economics has resulted in major economic and social losses to businesses and taxpayers. Fishery depletions in the U.S. cost \$8 billion annually and 300,000 jobs, according to the federal government.

In the twentieth century, ocean fish catches increased 25-fold, although catch rates per ton of fishing vessel have been falling since 1970 as fleets and fishing power grew—often swollen by subsidies—at rates greater than the ability of the fisheries to sustain them. In 1989, the total world catch of wild fish from the seas peaked at a little over 80 million metric tons. It has generally remained static since then, suggesting that for most areas of the world the limits of the seas have been reached.



Carl Safina

Many commercial fish and shellfish rely on rivers, marshes, and other habitats for breeding grounds and nurseries.

Bycatch: Casualties of Commerce

Virtually every kind of fishery unintentionally catches unwanted creatures, known as bycatch. Each year, about one-quarter to one-third of the world's total catch is simply discarded overboard, dead or dying. Indiscriminate fishing techniques cause this waste; this careless practice also pits fishery against fishery. Shrimp trawlers have more bykill than any other type of fishing gear: For every pound of shrimp kept, anywhere from a pound and a half to eight pounds of sea creatures, many of which are juveniles of commercially important species such as red snapper, are discarded dead. Shrimp trawls are the largest source of mortality in adult sea turtles, and in the U.S., shrimpers must now have "turtle excluder devices" in their nets to shunt turtles out. The highest amount of bycatch occurs in the Northwest Pacific: Nine million metric tons of catch is discarded annually.

Aside from problems of waste, bycatch can also deplete or endanger wildlife populations, including fish, sea turtles, birds, and marine mammals. For example, coastal gillnets threaten certain small dolphins and seals with extinction, and longlines set for tunas and swordfish are endangering several albatross species.

Fish Need Habitat, Too

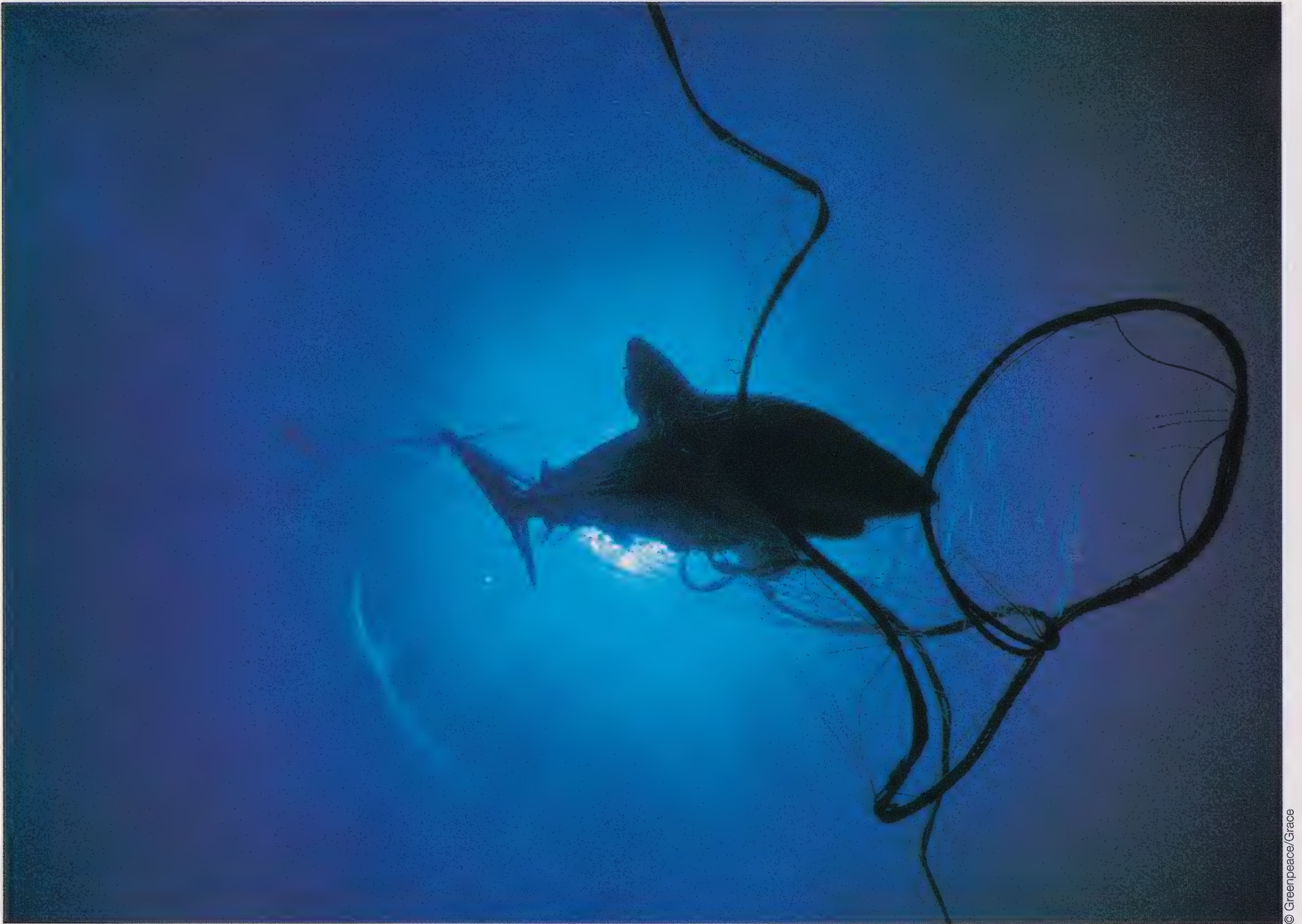
Three-quarters of our recreational and commercial fish and shellfish species depend on coastal ecosystems—estuaries, marshes, and rivers—as breeding grounds and nurseries. Yet development

continues to degrade and destroy these essential habitats, threatening both the health of marine fish populations and the future of fishing communities. The federal government estimates that ongoing inshore habitat losses cost the nation's fisheries more than \$27 billion annually in reduced catches.

Fishing practices can also alter fish habitat. In many regions of the world's continental shelves, bottom-dwelling animals and plants (many of which feed and shelter fish) have been seriously damaged by commercial trawling. Divers throughout the tropical Indo-Pacific region use cyanide to catch fish, but this also kills their coral habitats. Even fish farms can destroy essential fish habitat for wild populations because pens and artificial ponds often replace natural nursery habitats and pollute local waters. Aquaculture facilities have destroyed many mangrove tracts in Thailand, Ecuador, and other areas. The submerged roots of these salt-tolerant trees provide essential spawning and larval growth habitat for shrimp and fish. Their loss not only hurts wildlife populations, it also contributes to malnourishment of local people—the shrimp and fish grown in the tropics are almost all exported to developed countries, not used as local food.

Ecological Effects

The effects of overfishing go beyond straightforward depletion. Intensive removal of adults can drastically alter a population's age structures and sex ratios and greatly reduce spawning potential.



© Greenpeace/Grace

Nontarget species are caught and killed in many fishing operations. This white-tipped shark died in a driftnet.

Adult removal can even cause genetic changes, including miniaturization through the disproportional survival and reproduction of small, early maturing individuals.

In some parts of the world, overfishing is starving fish-eating birds and marine mammals. The best-studied example is in Great Britain's Shetland Islands, where extensive fishing for sandeels depleted this prey species so severely that Arctic terns, puffins, and other birds that prey on sandeels failed to breed for nearly a decade, beginning in the early 1980s.

Selective depletion of marine organisms can cause profound changes in ecosystem structure. One example can be seen on Georges Bank, an area off the New England and Newfoundland coasts that has been jointly overexploited by the U.S. and Canada. The area's once-dominant cod, flounder, and haddock have been replaced by skates and small sharks called dogfish, resulting in significantly different patterns of energy flow and fears that the latter species could suppress recovery of the overfished former-dominants. On the other hand, the long-lived, slow-reproducing dogfish, formerly unmarketable, are now already being rapidly depleted in a new, unmanaged fishery.

Management Problems

Management of fisheries is fraught with problems. In many regions, there are no data with which to manage. For example, increasing demand for shark fins in China has driven many shark



© Robert Visser/ Greenpeace

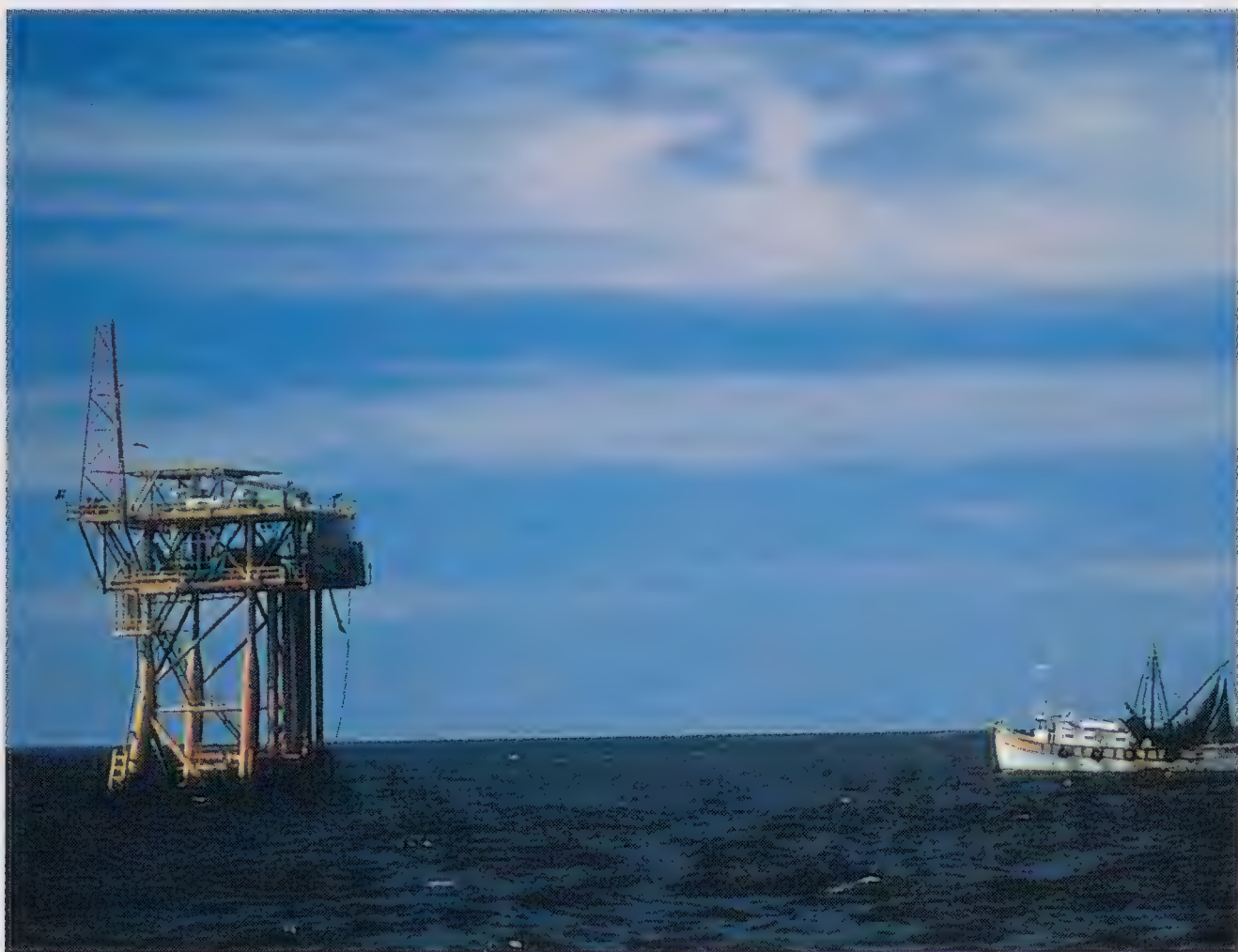
In this century, ocean fish catches have increased 25-fold. But the increased pressure on fisheries has caused catch rates to drop since 1970.

populations around the world to low levels since the 1980s, but quantitative data on the amount of fish caught, much less on population trends, are spotty at best. Where data do exist, they have, for the most part, been disregarded by managers and policymakers. The International Commission for the Conservation of At-



© Robert E. Mumford, Jr.

In the Shetland Islands, overfishing of sandeels caused puffins to stop breeding for nearly a decade.



© Robert Visser/ Greenpeace

Many human activities, including oil drilling and shrimp trawling, adversely affect ocean wildlife.

Atlantic Tunas, for instance, has never since its inception in the 1960s been in compliance with its charter obligation to manage for sustainable yields, despite having the world's best data on regional population trends for tunas and billfishes. It has made few management recommendations, has allowed the severe depletion

of western Atlantic bluefin tuna and swordfish, has belatedly set catch limits that are too high to allow recovery of these species, has allowed overfishing and regional depletion of other tunas and billfishes, and still has no management or recovery plans for any species.

A Change In the Wind?

Despite chronic problems, the sea breezes are beginning to shift. In the U.S., more than 100 conservation, fishing, scientific, and diving groups banded together to form the Marine Fish Conservation Network, and at the end of 1995 they achieved a sweeping Congressional overhaul in federal fisheries law that would have been unthinkable only three or four years earlier. Implementation of these major changes should fundamentally improve fisheries management and marine resource abundance in U.S. waters.

In November 1994, mounting concern about the role that trade plays in threatening shark species led to the unprecedented decision by countries that are signatories to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to review the biological and trade status of sharks globally. This is the first time that a truly valuable commercial fishery has been accepted into the CITES agenda, laying the necessary groundwork for regulating trade in sharks and shark products throughout the world.

The United Nations Food and Agriculture Organization once



© Robert Visser/ Greenpeace

About one-quarter to one-third of the world's total catch is discarded, dead or dying, as bycatch.

helped shepherd the world into its current state of catch-as-catch-can frenzy by encouraging and helping countries to expand their fishing fleets as a way of increasing economic wealth and independence. Reports from this world fish authority now ring with ominous warnings and recommendations, saying that 70 percent of the world's populations of marine fish, crustaceans, and mollusks are fully fished or have been overexploited, and that conservation measures must be implemented to reverse these trends. The United Nations imposed a global ban on large-scale driftnetting in the early 1990s. And in 1995, the U.N. passed a new treaty on high-seas fishing, which, if implemented in coming years, may well be the most important action ever taken for establishing a sustainable regime for the world's fisheries.

The end of a long era of mythical limitlessness and ideological freedom in the seas is upon us. Does this mark the beginning of better stewardship and recovery?

Carl Safina is senior ecologist at the National Audubon Society, and the director of its Living Oceans Program. Mercédès Lee has been a writer and science editor for the National Audubon Society for the last 10 years. She is currently outreach coordinator for Audubon's Living Oceans Program.



© Aaron Norman

Atlantic salmon and other fish have been driven to commercial extinction in large parts of their range.

The Amazonia Science Gallery, for Science's Sake

Lily Whiteman

Photos: Jessie Cohen/NZP

Ask typical teenagers to name sports or music stars, and lists of idols roll off their tongues. But ask them to name important scientists; and they tend to become tongue-tied. Why the difference? It's not just that scientific discovery is perceived as less dramatic than arena athletics and rock extravaganzas, or that most science luminaries lack the big muscles, big money, and flamboyance of many high-profile figures. Something deeper seems to be discouraging young people from becoming science junkies.

Some critics blame scientific illiteracy on flawed education. Indeed, five new Nobel Prize winners recently slammed U.S. science education as downright "abysmal" and in "decay," according to the *New York Times*. With students deprived of inspirational exposure, science fails to attract a following proportional in size to its importance.

THE LABORATORIES

But if to know science is to love science, then the National Zoo's new Amazonia Science Gallery—the Smithsonian's first exhibit dedicated solely to the process of scientific discovery—should go a long way toward boosting the popularity of critical scientific disciplines. At the heart of the Science Gallery, which opened on December 16, are four active laboratories that put behind-the-scenes research squarely at center stage. Here, visitors are invited to watch scientists conduct experiments, and chat with them about their findings. (Although feeding the scientists is strictly verboten.)

The Science Gallery laboratories currently focus on animal nutrition, behavior and bioacoustics, genetics, and biodiversity. With an armamentarium of high-tech hardware, including a DNA sequencer that cracks the codes of genetic material, a scanning

electron microscope that magnifies specimens thousands of times, a voice print analyzer that converts animal calls into graphical representations, researchers wrestle with diverse ecological questions. Can, for example, beleaguered desert tortoises still scrape together nutritional meals as their food supply dwindles under the hooves of growing cattle populations? Will DNA typing characterize the North American gray seal as monogamous? How does living in a zoo affect animal behavior?

Only legitimate research, unadorned with gratuitous window dressing, is conducted at the Science Gallery. "This is the real thing; scientists work here, just as they do in their regular laboratories," affirms David Jenkins, Associate Director for Interpretive Programs. "Everything at the Smithsonian...the exhibits, science programs, and publications, are all based upon research," adds Miles Roberts, Deputy Head of the Department of Zoological Research. "And one of the Zoo's greatest strengths is conservation and basic research. Until now, few visitors knew that. The Science Gallery exposes some of the huge sections of the iceberg that visitors wouldn't otherwise see."

The Science Gallery is connected to the Amazonia Exhibit—a cageless, no-holds-barred swath of indoor rainforest, where birds, sloths, monkeys, and others roam freely amid ambling visitors. As Amazonia's neighbor, the Science Gallery is positioned to suggest a jungle laboratory, where animal and plant samples from surrounding environs are analyzed. But absent from the Science Gallery are the clinical clutter, hard edges, and "do not enter" signs that wall off the public from more traditional research facilities. Rather, laboratories recessed from a sunny breezeway, colorful displays, and latinesque arches reinforce the Science Gallery's "open house" ethic.

Visitors to the Amazonia Science Gallery discuss the workings of an electron scanning microscope with a Zoo scientist.





At the center of the exhibit is a huge globe that will bear a composite satellite picture of the world.



OTHER DISPLAYS

Complementing the Gallery's laboratories are a variety of multi-media displays on global ecology. Among these are easy-to-use interactive computer programs, videos, explanations of the uniqueness of rainforests, a huge globe that will soon bear a composite satellite picture of Earth, literature ranging from wildlife coloring books to scholarly articles, microscopes with specimens such as insect parts, and a television monitor showing up-close-and-personal views of writhing worms that will be served to Amazonia's fish. A showcase of postcards sent by Smith-

sonian scientists from far-flung locales mentions tasks, such as recording the screeching calls of bats in Trinidad and analyzing macaque weight data in Sri Lanka, that underscore the extraordinary rigors and rewards of fieldwork.

SCIENCE GALLERY BENEFITS

As more and more print media and television programs are "dumbing down" to cater to shrinking attention spans, the Science Gallery resists the trend. And although most displays will likely be of broad appeal, a poster entitled, "A Molecular Analysis of the Radiation of the Hawaiian Honeycreeper," exemplifies other materials that—while hardly the stuff of cocktail party banter—will probably draw more specialized crowds. The Science Gallery's relatively highbrow approach was sanctioned by preliminary surveys of National Zoo visitors revealing that "we have a very educated audience," says Jenkins.

Nevertheless, this same survey also reflected a widespread inability to personalize science. Few visitors, for example, asked to name a prominent scientist mentioned anyone but Albert Einstein, who was identified by one respondent merely as "that dude with the weird hair." In addition, when another survey asked students in minority schools to draw a scientist, to a person they sketched a balding, bespectacled white man in a lab coat.

The persistent view of scientists as one-dimensional creatures is probably related in part to the general under-representation of women and minorities in the field. Indeed, *Science* recently reported that while women are starting to close the gap, minorities earned only about ten percent of all science and engineering Ph.D.s in the United States in 1994. "Most of us scientists can go back to one or two people early in our lives who really got us interested in science, who encouraged us, or were examples of some sort," says Roberts. "Without many mentors, an awful lot of African American and Hispanic children simply don't know they can aspire to be scientists," observes Jenkins. "We are fortunate. We have a very diverse group of scientists." And by encouraging the public to interact with this group, the Science Gallery should help expose the individual nature of science, and promote the appeal of various scientific disciplines.

But just as teaching hospitals are designed to instruct medical students as well as to benefit patients, the Science Gallery is built to train scientists in addition to educating visitors. Roberts explains: "Many scientists work at the Smithsonian during their training as students, postdoctoral fellows, and research associates.

*Visitors put
themselves in the
shoes of
scientists.*



In the molecular genetics lab, a Zoo scientist explains her work and how it relates to mosquitoes and the avian malaria they transmit to Hawaiian honeycreepers.



They'll write papers that maybe six people in the world actually read. But the whole business of interacting with real people and explaining their findings has been missing from their education in the past.

"What we are doing here is a kind of cultural shift," continues Roberts. "All Gallery scientists will be expected to spend about 20 percent of their time in some sort of public interaction or education." In addition to the Science Gallery, the Zoo also encourages researchers to interact with the public through the "Scientist in the Classroom" program.

This project sends researchers into fourth and fifth grade classes to discuss their work. If all goes as planned, such programs will help add the stereotypical "nerdy" scientist to the endangered species list.

In addition, in these days of diminishing federal dollars, researchers realize that their success at winning grants from private sources will partly depend on their ability to repackage science for mass appeal. "We need to have a group of people out there who care enough about what we do to fund us," says Roberts. The Science Gallery represents one way to kindle this kind of supportive interest.

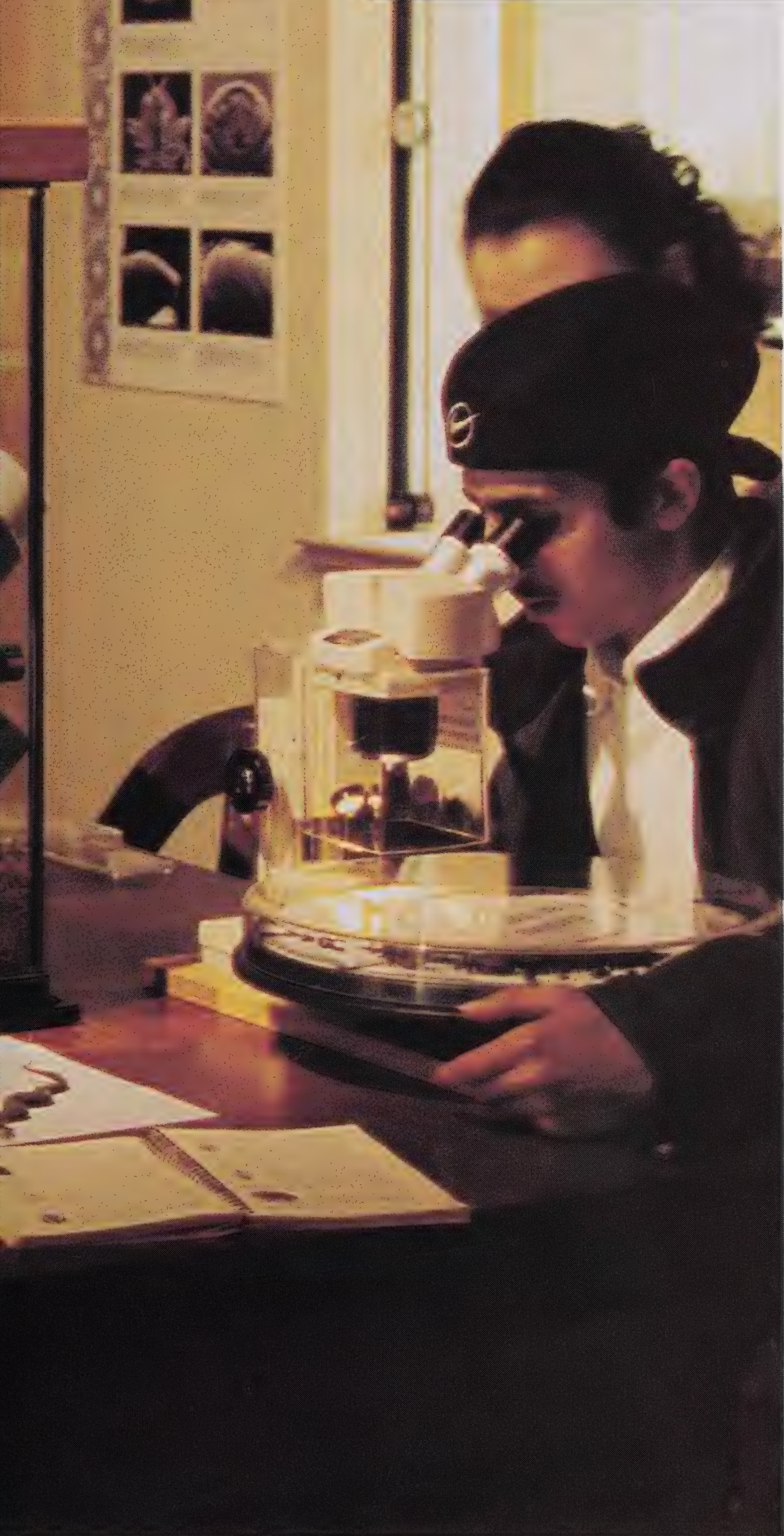
WHERE AND HOW THE SCIENCE GALLERY IS GOING

Visitors invariably describe the Science Gallery with enthusiastic adjectives, such as "enlightening," "awesome," "cool," and "fun." One exception, however, was a youngster who experienced the exhibit viscerally. "Your worm things made me sick," he wrote in a comment book. "I probably will never sleep again." But at least one adult responded to the exhibit more flippantly: Looking into a microscope while citing a line from *Frankenstein*, he exclaimed, "It's alive!"

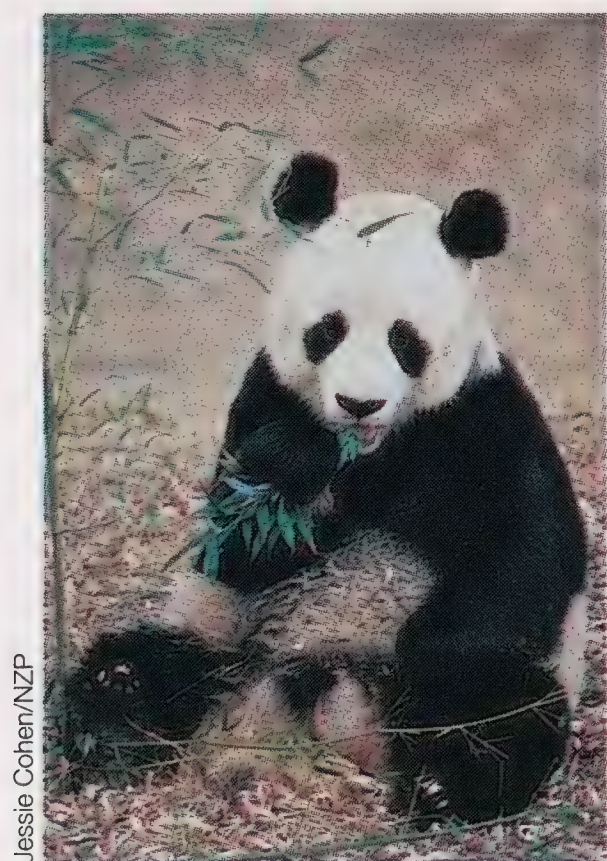
The Science Gallery also elicits non-verbal signs of approval—as it recently did from a school group recruited to assist with genetics experiments. No sooner had the children donned white coats and gloves when they practically stampeded the laboratory to take turns helping to isolate DNA. Robert Fleischer, Head of the Zoo's Molecular Genetics Program, remembers: "The solution came streaming down from a glass rod. It was icky. The children had big smiles. They loved it."

The Science Gallery will frequently be updated to reflect the changing emphases of visiting scholars, research grants, and relevant news events. As a continual work in progress, this new addition is designed as the "Zelig" of exhibits, constantly dishing out surprises that demand repeat visits. Perhaps in future incarnations, the Science Gallery will showcase the contributions of experts whose ecological curiosity was initially sparked by its own laboratories.

Lily Whiteman is a freelance environmental writer who lives in Washington, D.C.



notes & news



Jessie Cohen/NZP

Calendar Correction: Make Way for a Giant Panda Celebration

This year, Friends of the National Zoo will be celebrating giant panda Hsing-Hsing's 25 years at the National Zoo. This event will take place in lieu of the Earth Days Celebration, so please update your 1997 FONZ calendar to reflect this change of events. On Saturday, April 19, and Sunday,

April 20, a variety of panda- and China-related activities will be going on at the Zoo. Admission is free. For information call 202.673.4717.

Guppy Gala, set for Friday, May 9, from 6 p.m. to 8:30 p.m., is the second annual Friday evening romp for children and their families. This event is packed with fun diversions: magicians, arcade games, karate demonstrations, story tellers, dancers, puppets, a toddler play area, and the chance to climb behind the controls of a fire engine, backhoe, and other parked vehicles.

This event is generously underwritten by Borden and EU Services.

Tickets are \$15 for FONZ members and \$18 for the general public. Proceeds benefit education programs at the National Zoo. For tickets and information call 202.673.4613 during normal business hours.

Wet and Wild ZooFari focuses on fun, food, and music for an adult crowd. This year, on Thursday evening, May 15, from 6:30 p.m. to 11 p.m., 100 of the Washington area's finest restaurants will occupy the Zoo and serve their fare. The Fabulous Hubcaps are among the variety of live entertainment lined up for this gala fundraiser. There will also be a silent auction, animal demonstrations, arcade games, and a sweepstakes (watch the mail for your sweepstakes package, which should arrive soon).

Single tickets are \$95 for members (\$70 of which is tax deductible) and \$115 for the general public (\$90 of which is tax deductible). In addition, three types of tables are available:

Sea Lion tables, which seat 10 and come with an additional five tickets, are hosted by a Zoologist at the table area of your choice. Your Zoologist will take you on a behind-the-scenes tour of her or his exhibit area; you choose which area you want to tour. The cost of a Sea Lion table is \$3,000 (\$2,625 of which is tax deductible). **Otter** tables seat 10 at your choice of table location for \$1,500 (\$1,250 of which is tax deductible). And **Piranha** tables seat four and come with three additional tickets for \$1,000 (\$825 of which is tax deductible).

This year's ZooFari is generously underwritten by BET, Chevy Chase Bank, The Coca-Cola Company, EU Services, GEICO, Greater Washington GMC Dealers, MIX 107.3 FM, The Purina Cares Fund, Washington Gas, and W*USA-TV.

ZooFari proceeds benefit the Theodore H. Reed Animal Fund, with money earmarked for conservation, education, and Zoo exhibit programs. For tickets and information call 202.673.4613 during normal business hours.

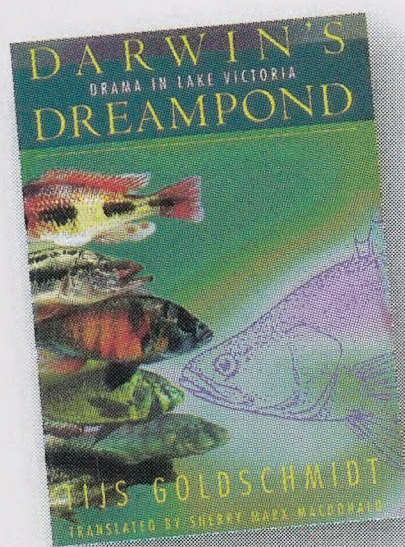
Dial for Tiles

In March or April, the wall surrounding Lion/Tiger Hill will be covered with hundreds of terra cotta plaques honoring zoogoers of all types. As a FONZ member, you can purchase a Wildlife Walls tile for yourself or a loved one at a discounted price. Wildlife Walls tiles make unique and enduring gifts, and are available in different sizes. All tiles accommodate inscriptions, and larger-sized tiles can be decorated with a bas-relief animal sculpture of your choice. Wildlife Walls purchases are tax deductible and benefit conservation, education programs, and exhibits at the National Zoo. Call 202.673.4613 for information and orders.

ADOPT YOUR SPECIES!

Another new FONZ program benefits the care and feeding of the Zoo's animals and plants. **ADOPT A SPECIES** allows you to choose from more than 40 "adoptable" animals and plants. Six support levels range from \$25 to \$1,000, and are tax deductible. In return, **ADOPTers** are entitled to a variety of benefits, depending on the contribution level selected. All **ADOPTers** receive information about the animal or plant they choose. Your contribution goes to the care and feeding of the Zoo's 5,800 animals of about 500 species and its many plants. To sign up for the **ADOPT A SPECIES** program, call 202.673.4613.

books, naturally



Darwin's Dreampond: Drama in Lake Victoria. 1996. Tijs Goldschmidt (translated by Sherry Marx-Macdonald). The MIT Press, Cambridge and London. 276 pp. hardbound, \$25.

The cichlid fish of Africa's Lake Victoria were so little known to scientists when Tijs Goldschmidt and a group of Dutch biologists set out to study them that "There was no reason. . .to go to libraries and read volumes of tedious articles. We would write these ourselves later." Undoubtedly Goldschmidt has written some tedious articles for scientific journals, but you couldn't tell on the evidence of *Darwin's Dreampond*. This is a very good book.

When raising the alarm on rainforest destruction and other unnatural disasters, conservationists often decry the loss of species not yet known to science. But these unknown species are theoretical. We have no idea what they might have been, only that they must have been. Not so for the loss of unknown species of furu, as Lake Victoria's cichlids are called. We know that unknown furu went extinct in full view of the scientists, like Goldschmidt, who were trying to catalog them. In fact, as the author recounts, after seeing one too many furu on a collecting trip, he himself "threw back" a furu never seen before or since.

Goldschmidt and his fellow Dutch biologists hit the Tanzanian shores of Lake Victoria in 1981, and found a gold mine of furu. (A somewhat mixed blessing to the biologist, who notes that "Nothing is more stultifying than discovering something new every week.") In virtually no time at all, they'd found more than 300 species of furu in one

small bay of this huge lake (which is larger than the state of Maryland), fully half of which were previously undescribed.

These brightly colored small fish, ranging from two to ten inches in length, were a marvelously diverse bunch, more easily differentiated by their habitat and feeding adaptations than by morphological differences. Among the furu were multiple species of insect-eaters and prawn-eaters, mud-biters and algae-scrapers, snail-crushers and snail-shellers, leaf-choppers and zooplankton-eaters, cleaners and scale-scrapers, fish-eaters galore, and a group of 13 species known as pedophages, "child-eaters," dining on the embryos or fry of other furu. Within each group even more narrow specialties emerge. Among the pedophages, for instance, some are rammers, which bash a mouth-brooding female so she opens her mouth and releases her young to be gobbled up. One species rams the female by approaching at an angle from below her; another blasts straight up; a third rams from above. This enormous diversity within a single group is unparalleled, putting Darwin's Galapagos finches with their paltry 14 species to shame. The story of this spectacular evolution of furu was the subject of Goldschmidt's science, and forms the "Darwin's Dreampond" part of his book.

By 1985, about 200 of these species were extinct, victims of a single large species of fish-eater, the Nile perch. Nile perch were introduced—at first surreptitiously by "one man with a bucket" in the early 1950s and officially in the 1960s—to provide much-needed protein for people living around the lake and to form the basis for a fishing industry as well. Judged solely on these merits, the introduction has to be deemed a success, at least so far. But the

consequences for the furu were devastating. Moreover, the ecology of the lake is irrevocably changed. This story, to which Goldschmidt was a witness, and which turned him into a somewhat reluctant conservationist, comprises the "Drama in Lake Victoria" part of the book.

Tying these parts together is Goldschmidt's own story of life as a Western fish biologist working in a Tanzania of warm beer and malaria, of long lines and even longer waits for planes that never arrive, of petty bureaucrats and nosy policemen, and of patient fisherman who humor Goldschmidt as he collects tiny furu when there are, quite literally, bigger fish to fry and who become his friends and confidants. Goldschmidt writes with a wry sense of humor and possesses an ability, rare among scientists, to poke fun at himself.

Most intriguing is Goldschmidt's balance and optimism. Even while watching the species of his life's work disappear into the guts of Nile perch, he appreciates how the Nile perch has filled the guts of many, many people who now have a life's work. And, in the furu species that do remain, he sees potential for new species to emerge. The first hint of this comes at the end of the book, when a Japanese scientist finds possibly new species in the same bay so carefully combed just a few years earlier by Goldschmidt's team. More recently, in another part of the lake, another survey team found about 60 species of furu, about half of which were previously unknown. Are these simply species previously overlooked or new species, recently evolved in Lake Victoria's changed environment? Some of both? We may never know, but as Goldschmidt makes happily clear, the drama in Darwin's Dreampond is far from over.

—Susan Lumpkin



The Area Scene

The arrival of ospreys (*Pandion haliaetus*) in our area is a true sign of spring. These large fish-eating raptors winter in the southern U.S., the West Indies, and Central and South America. They return in March to nest on trees, channel markers, and duck blinds. If an old nest is not available, a pair will build a new one of sticks and other debris. Ospreys usually lay three eggs, which hatch about 40 days later. Young grow rapidly and can be seen perched atop many channel markers in the Bay and its tributaries, including the Potomac. The Chesapeake Bay area provided one of the osprey's few strongholds during the 1950s, 1960s, and 1970s, when the pesticide DDT accumulated in the fish ospreys ate and caused severe population declines. Osprey populations in many areas have since rebounded (following the ban on DDT), and the Chesapeake Bay area hosts one of the continent's densest populations.

The Good News...

In the November/December 1995 issue, we reported on the probable extinction of the ivory-billed woodpecker in its last stronghold in Cuba. Now there's word of a new discovery that sprang from the fruitless search for the woodpecker: A new frog species was found that ranks as the smallest in the Northern Hemisphere, and ties for the title of world's smallest frog. Soon to be formally named, this tiny Cuban amphibian measures less than a half-inch long, tiny enough to perch comfortably on a dime. The female frog lays only one egg at a time on land, and the young hatch as frogs, skipping an aquatic larval stage.

—From Science News, December 7, 1996

...The Bad News

Once widespread and plentiful, caimans are disappearing from many of Brazil's jungle rivers, swamps, and marshes, ac-

cording to a recent study of caiman populations in 47 locations. Three researchers, Peter Brazaitis, George Rebelo, and Carlos Yamashita, cite a variety of human-caused disturbances as the culprits. In many areas, caimans are illegally hunted for their skins or for food, or are adversely affected by pollution, ranging from chemical contamination from gold mining and other industries to heavy siltation from cattle ranching. All six of Brazil's caiman species face threats, but two were extensively studied: the common caiman (*Caiman crocodilus*), which was once abundant and is now possibly threatened throughout Brazil, and the much more scarce black caiman (*Melanosuchus niger*), which disappeared from 41 of the 47 sites during the four-year study.

—From New Scientist, November 2, 1996, and
Oryx, October 1996

What's in a Name

The world's three zebra species possibly got their name from the Congolese or Abyssinian word *zibra*, which means striped. These boldly patterned herbivores are among the most widely recognized of wild animals, so it might not be surprising that many other pied and striped creatures have been named after them. Here are some examples: zebra duiker, *Cephalophus zebra*, from Africa; zebra mouse, *Rhabdomys pumilio*, also from Africa; zebra mussel, *Dreissena polymorpha*, from Europe and Asia and introduced in parts of North America; two North American butterflies called the zebra, *Heliconius charitonus*, and zebra swallowtail, *Graphium marcellus*; Australia's zebra finch, *Poephila guttata*; North America's zebra-tailed lizard, *Callisaurus draconoides*; and an Indian fish called the zebra danio, *Brachydanio rerio*, which is also commonly found in home aquariums. Plants have also been named for zebras, including several tree species from the New World tropics called zebrawood, and the zebra plant, *Calathea zebrina*, from South America.

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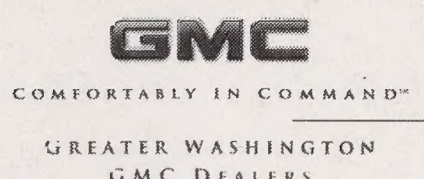


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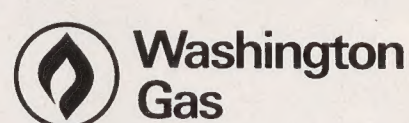
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